RELIABILITY REPORT

FOR

MAX1874ETE

PLASTIC ENCAPSULATED DEVICES

October 10, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX1874 successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

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I. Device Description

The MAX1874 charges a single-cell Li+ battery from both USB* and AC adapter sources. It also includes battery-to-input power switchover, so the system can be powered directly from the power source rather than from the battery.

In its simplest application, the MAX1874 needs no external MOSFET or diodes, and accepts input voltages up to 6.5V; however, DC input overvoltage protection up to 18V can be added with a single SOT PFET.

On-chip thermal limiting simplifies PC board layout and allows optimum charging rate without the thermal limits imposed by worst-case battery and input voltage. When the MAX1874 thermal limit is reached, the charger does not shut down but simply reduces charging current.

Ambient or battery temperature can be monitored with an external thermistor. When the temperature is out of range, charging pauses.

Other features include a CHG output to indicate when battery current tapers below a predetermined level. DC power-OK (DCOK), USB power-OK (UOK), and power-on (PON) outputs indicate when valid power is present. These outputs drive logic or power-selection MOSFETs to disconnect the charging sources from the load and to protect the MAX1874 from overvoltage.

The MAX1874 contains no logic for communication with the USB host. It must receive instructions from a local microcontroller. The MAX1874 is available in a 16-pin 5mm x 5mm thin QFN package and operates over the -40°C to +85°C temperature range.

B. Absolute Maximum Ratings

Item	Rating
DC, DCOK to GND	-0.3V to +20V
DCLV, BYP, USB, UOK, DCI, REF, USEL, THRM, EN, BATT, CHG, PON to GND	-0.3V to +7V
PGND to GND	-0.3V to +0.3V
Continuous Current (DCLV)	1.1A
Continuous Current (USB)	0.6A
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Maximum Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
16-Pin Thin QFN (5mm x 5mm)	1700mW
Derates above +70°C	
16-Pin Thin QFN (5mm x 5mm)	21.3mW/°C

II. Manufacturing Information

A. Description/Function:	Dual-Input, USB/AC Adapter, 1-Cell Li+ Charger with OVP and Thermal Regulation
B. Process:	S12 (Standard 1.2 micron silicon gate CMOS)
C. Number of Device Transistors:	4997
D. Fabrication Location:	Oregon or California, USA
E. Assembly Location:	Thailand or Hong Kong
F. Date of Initial Production:	July, 2003

III. Packaging Information

A. Package Type:	**16-Lead QFN (5x5)**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-Filled Epoxy
E. Bondwire:	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	Buildsheet # 05-9000-0470
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-A:	Level 1

IV. Die Information

A. Dimensions:	134 x 136 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Copper/Silicon
D. Backside Metallization:	None
E. Minimum Metal Width:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:

Jim Pedicord	(Manager, Reliability Operations)
Bryan Preeshl	(Executive Director of QA)
Kenneth Huening	(Vice President)

B. Outgoing Inspection Level: 0.1% for all electrical parameters guaranteed by the Datasheet.
0.1% For all Visual Defects.

C. Observed Outgoing Defect Rate: < 50 ppm

D. Sampling Plan: Mil-Std-105D

VI. Reliability Evaluation

A. Accelerated Life Test

The results of the 135°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 48 \times 2}$$

(Chi square value for MTTF upper limit)

└ Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 22.62 \times 10^{-9}$ $\lambda = 22.62$ F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure the reliability of its processes. The reliability required for lots which receive a burn-in qualification is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on lots exceeding this level. The following Burn-In Schematic (Spec. #06-6182) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

C. E.S.D. and Latch-Up Testing

The PM80 die type has been found to have all pins able to withstand a transient pulse of +/-1000V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX1874ETE

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
Moisture Testing (Note 2)				
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
Mechanical Stress (Note 2)				
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

Note 1: Life Test Data may represent plastic D.I.P. qualification lots.
Note 2: Generic package/process data

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except V_{PS1} 3/	All V_{PS1} pins
2.	All input and output pins	All other input-output pins

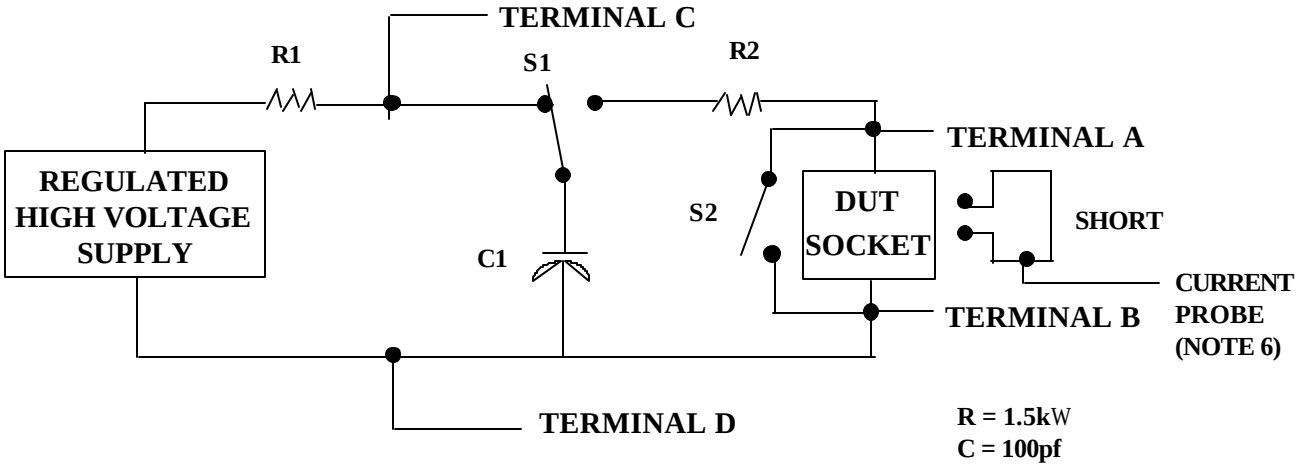
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

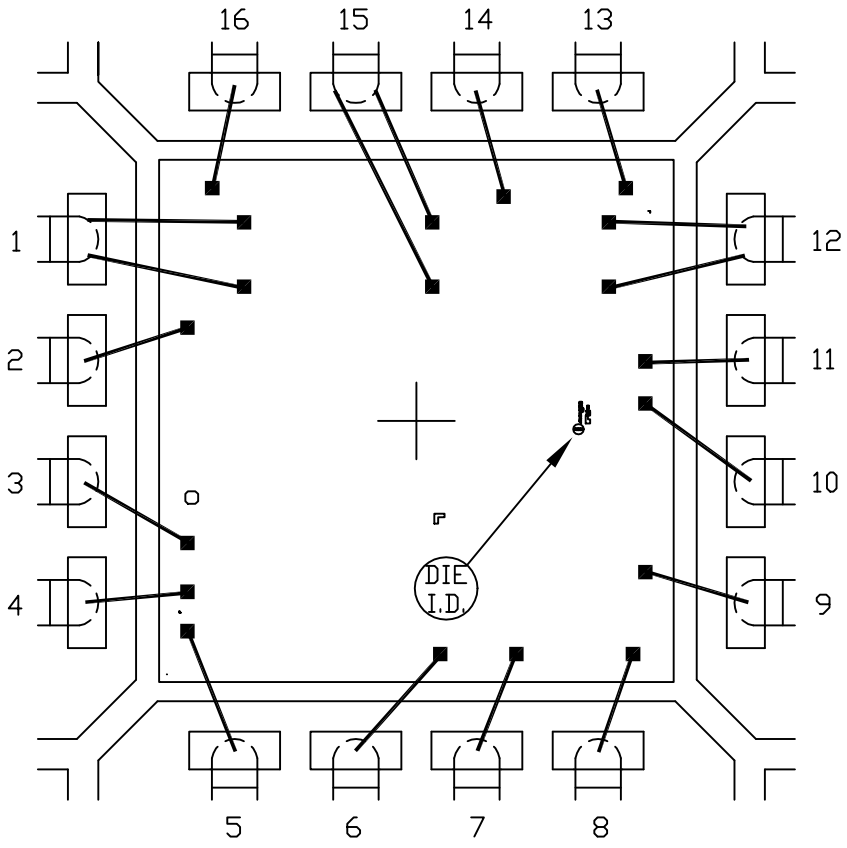
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.

c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



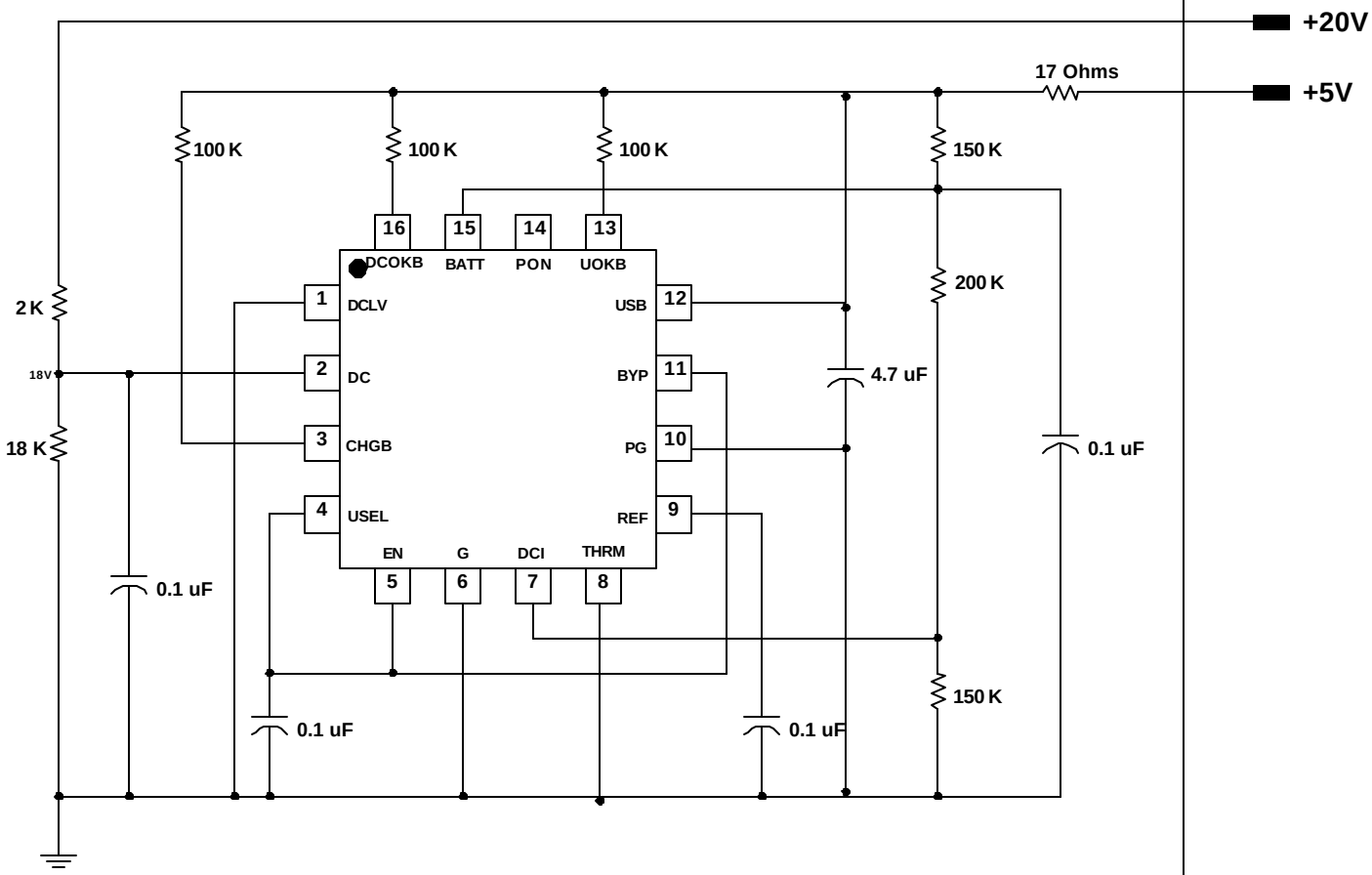
5x5x0.8mm QFN THIN PKG. EXPOSED PAD PKG.



PKG. CODE: T1655-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 146x146	PKG.			BOND DIAGRAM #: 05-9000-0470	REV: A
	DESIGN				

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 1874ETE (PM80)
PACKAGE: 16-QFN 5x5 THIN
MAX. EXPECTED CURRENT = 3 mA (+5V), 1.25 mA (+20V).

DRAWN BY: TEK TAN
NOTES: